

FIG. 1a

FIG. 1c

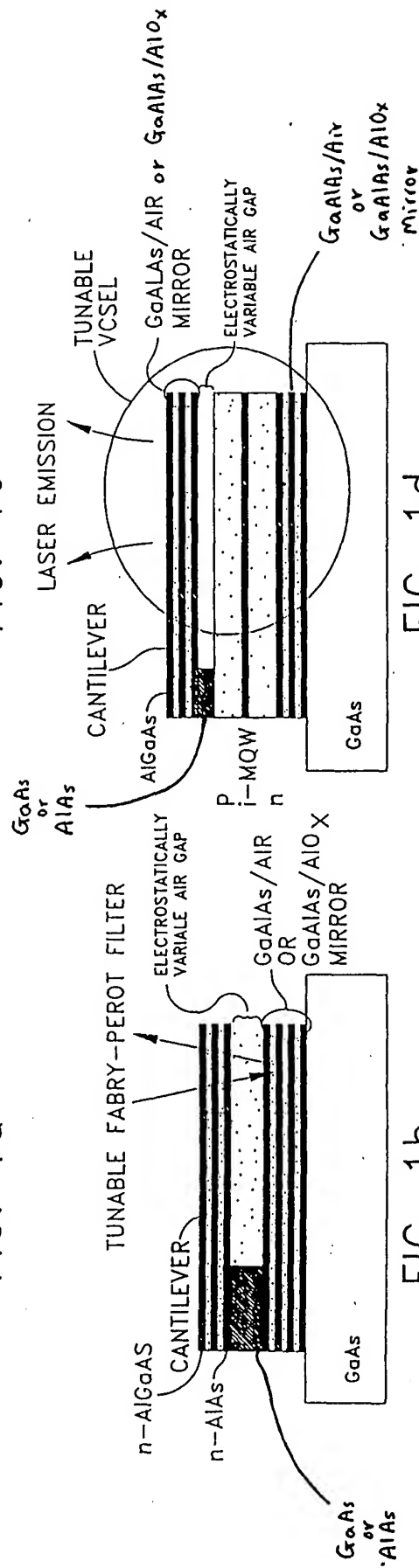
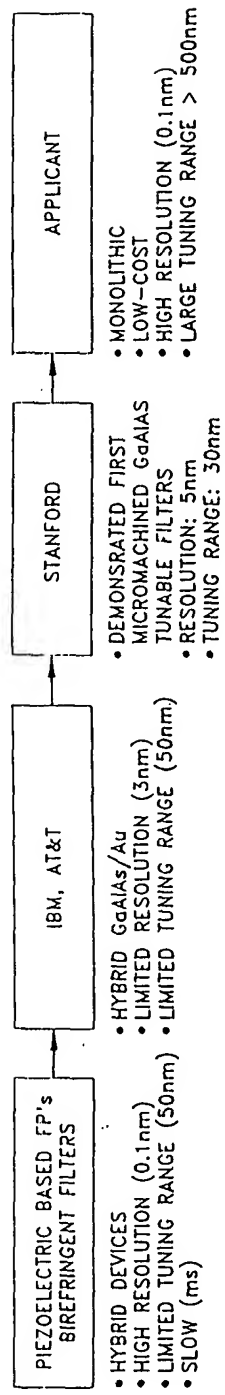


FIG. 1b

FIG. 1d

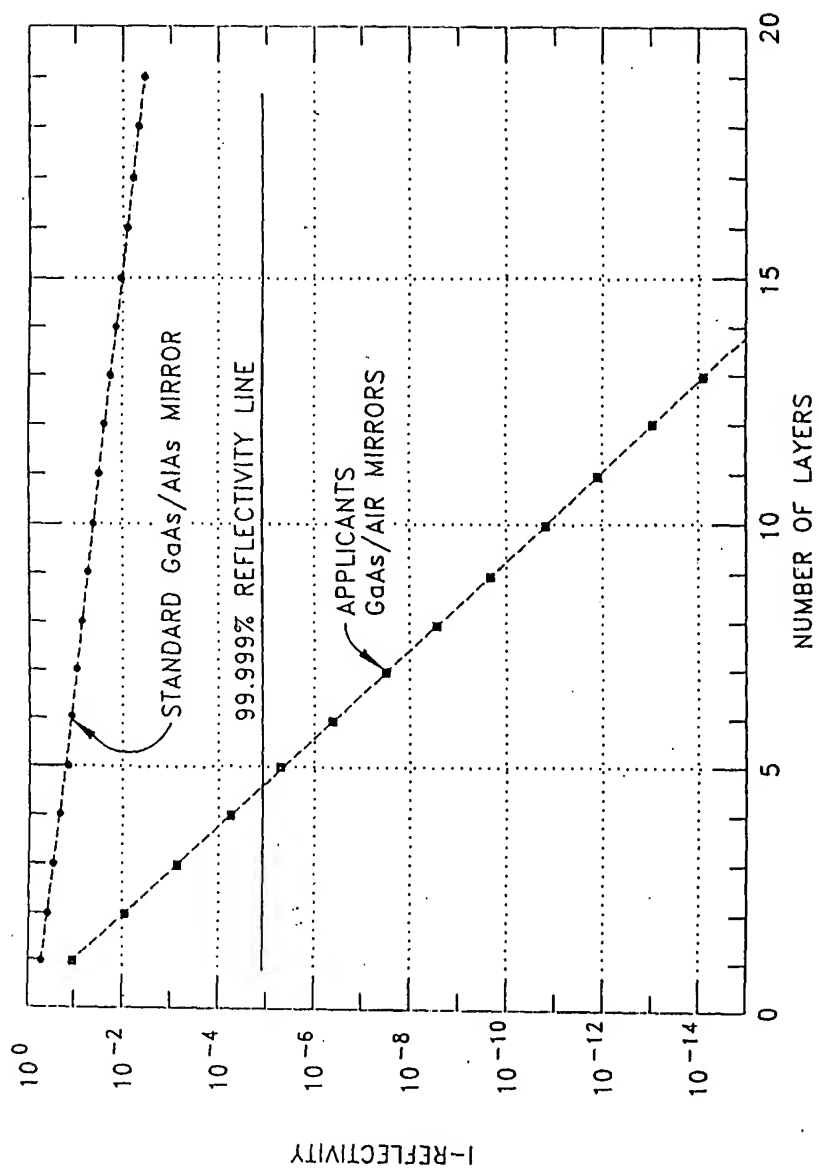
- (a) MY MICROMACHINED GaAlAs GaAlAs/AIR MIRROR CAN BE APPLIED TO FABRICATE
- (b) BROADLY TUNABLE FABRY-PEROT FILTERS
- (c) HIGH YIELD, LOW THRESHOLD VCSELS AND
- (d) BROADLY TUNABLE VCSELS



*HYBRID MEANS INTEGRATION OF DISCRETE DEVICES OR COMBINATION OF GaAs AND SI TECHNOLOGIES

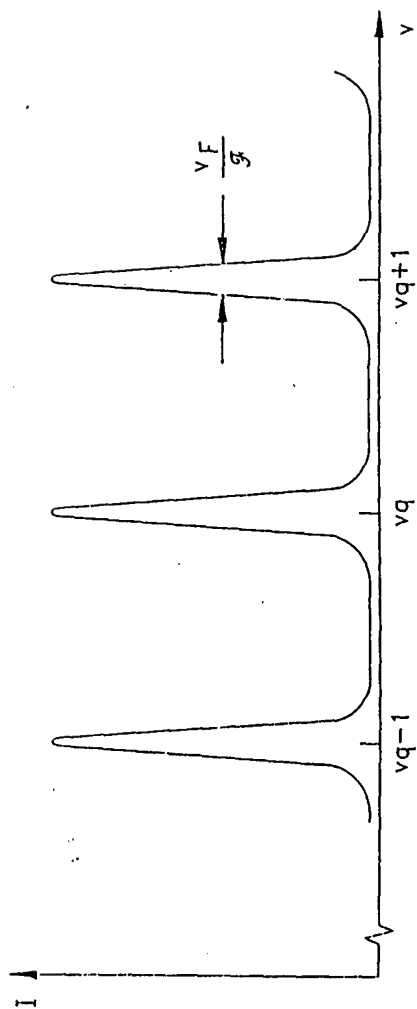
PROGRESS OF TUNABLE FABRY-PEROT TECHNOLOGIES

FIG. 2



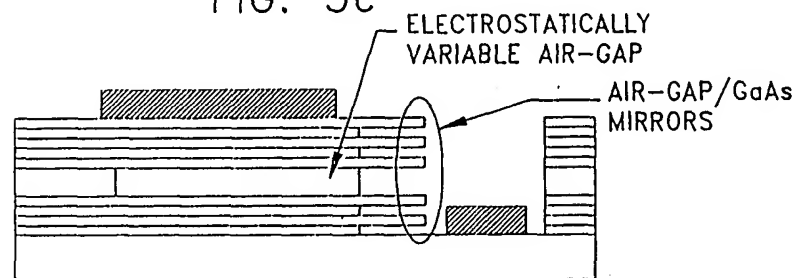
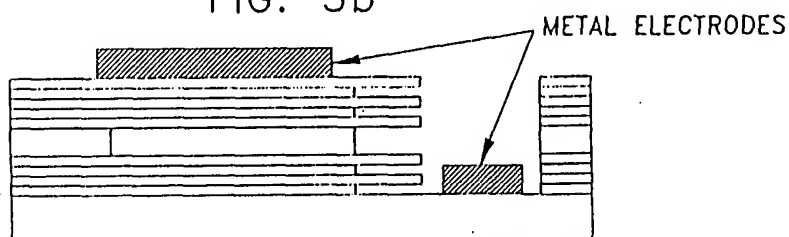
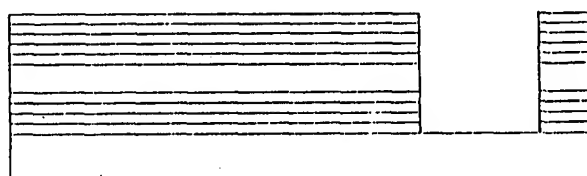
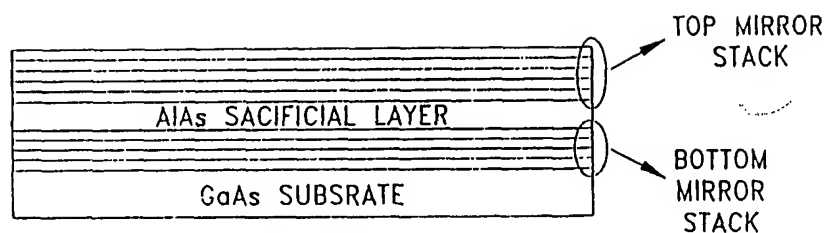
REFLECTIVITY OF DISTRIBUTED BRAGG REFLECTORS CONSISTING OF DIFFERENT MATERIALS. DUE TO LARGE INDEX VARIATION GaAs/AIR-GAP MIRRORS GIVE THE HIGHEST REFLECTIVITY WITH MINIMUM NUMBER OF LAYERS

FIG. 3



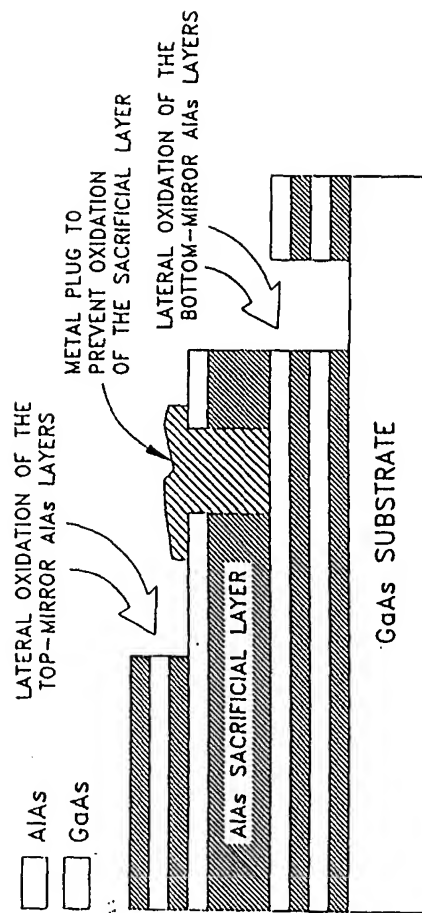
THE FREQUENCY SPECTRA OF A TYPICAL FABRY-PEROT STRUCTURE

FIG. 4



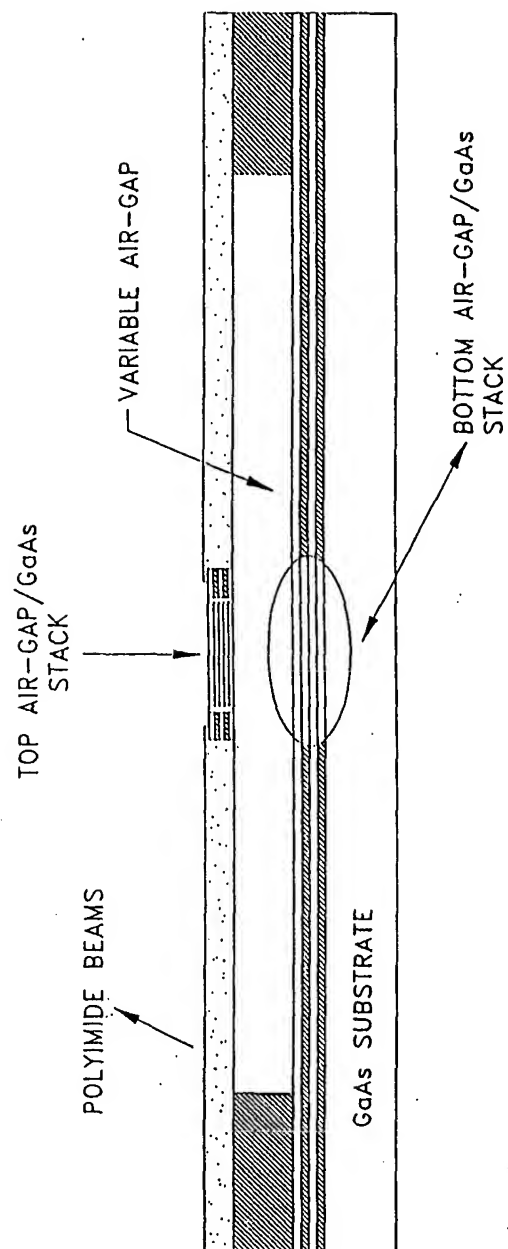
FABRICATION SEQUENCE FOR THE CANTILEVER-SHAPED TUNABLE FILTERS

- (a) THE INITIAL STARTING SUBSTRATE
- (b) OPENING OF CRATERS TO BE ABLE TO REMOVE AlGaAs LAYERS FROM THE BOTTOM MIRRORS DURING THE SUBSEQUENT STEPS
- (c) DEFINITION OF CANTILEVER STRUCTURES
- (d) REMOVAL OF THE SPACING AND LOW INDEX MATERIALS TO FINALIZE THE DEVICE FABRICATION



AN ALTERNATIVE APPROACH TO AIR-GAPS IS THE OXIDATION OF AlAs LAYERS. AlAs CAN BE Laterally OXIDIZED. IN MY CASE, THE OXIDATION OF THE SACRIFICIAL LAYER SHOULD BE AVOIDED AS IT WILL Later BE REMOVED TO ACHIEVE A TUNABLE CAVITY. THEREFORE, THE USE OF A METAL PLUG IS A CRITICAL STEP IN MY FABRICATION SEQUENCE.

FIG. 6



A "TRAMPOLINE" PLATFORM CAN BE USED INSTEAD OF A CANTILEVER AS THE MOVABLE TOP MIRROR TO IMPROVE THE FREQUENCY RESPONSE OF THE PROPOSED DEVICE.

FIG. 7

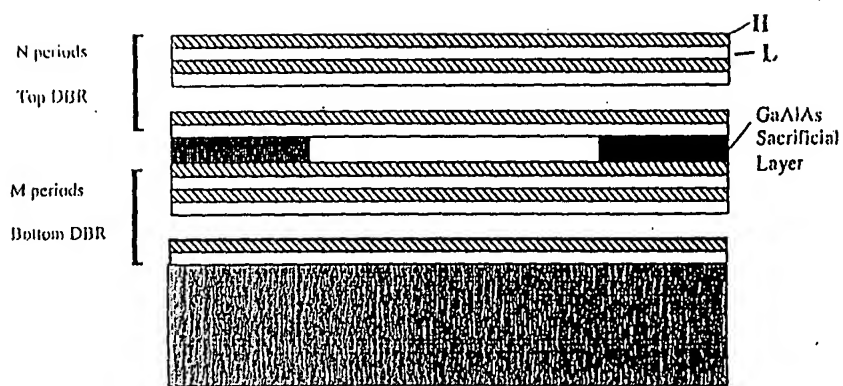


FIG. 7A

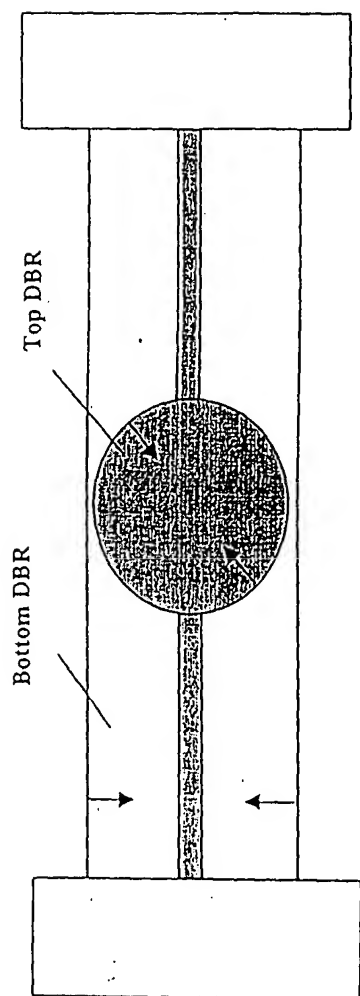


FIG. 7B

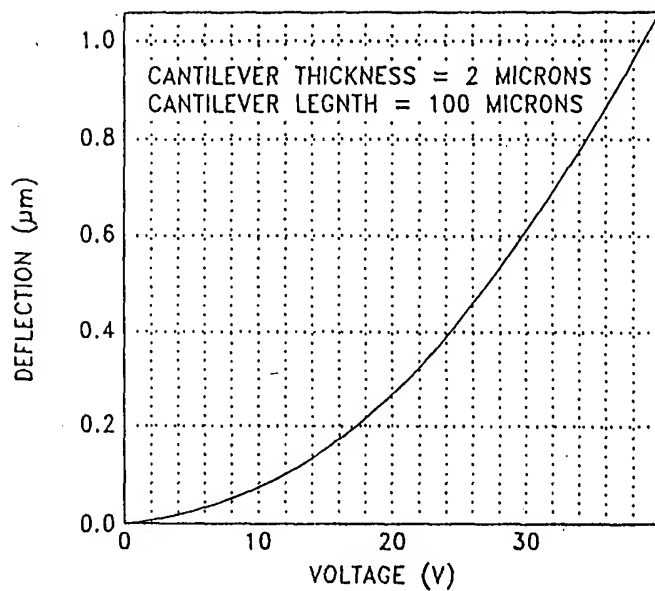


FIG. 8a

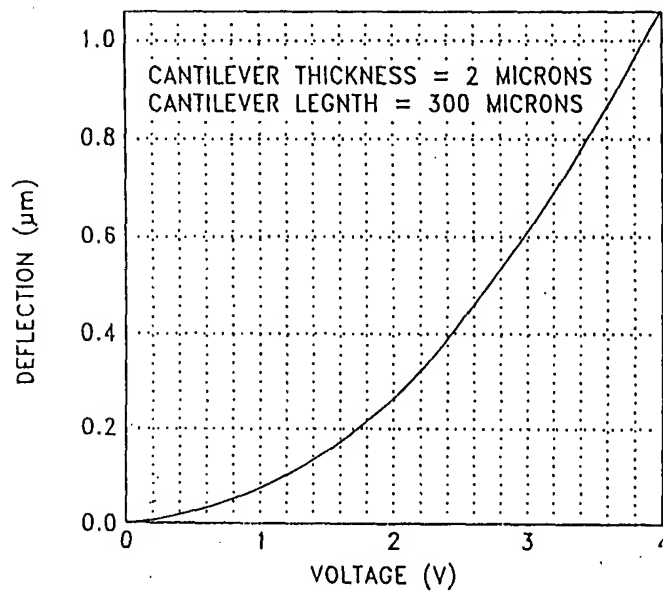
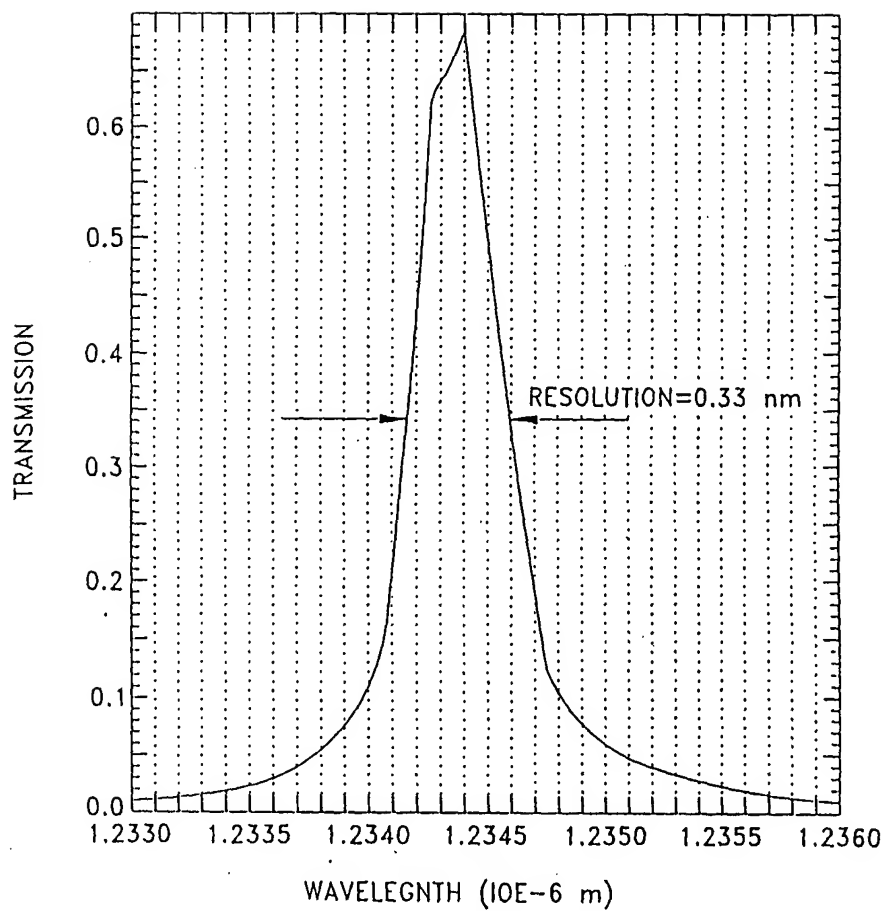


FIG. 8b

THE AMOUNT OF BENDING WITH APPLIED VOLTAGE
(a) FOR A 100 μm LONG DEVICE AND,
(b) FOR A 300 μm LONG DEVICE



THE SPECTRAL RESPONSE OF THE PROPOSED DEVICE. ONLY 2.5 MIRROR PAIRS WERE USED IN EACH STACK OF THE FABRY-PEROT STUTURE.

FIG. 9